

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

May 26, 2011

Indiana Department of Environmental Management
OWQ Data Management Section
100 North Senate Avenue
Indianapolis, IN 46206

Subject: NPDES Permit No. 0000108 Semi Annual WET Testing Results

Please find enclosed two copies of the Whole Effluent Toxicity Report for BP Products North America Inc. – Whiting Business Unit for the month of April 2011. Results are reported according to EPA 821-R-02-013 Section 10 (Report Preparation) for NPDES permit IN0000108 Outfall 005 Effluent. Chronic Toxicity T_{Uc} was 1.0 and Acute Toxicity T_{Ua} was <1.0.

BP plans to conduct WET testing in April and October of each calendar year. The next sampling event will be in October 2011.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions or need any additional information, please contact Valorie L. Moore at (219) 473-2095.

Sincerely,

Nick Spencer
Business Unit Leader

Attachments

Document ID WBU-DENV-4G05-44084



Whole Effluent Toxicity Test Results

Prepared for:
BP Products North America
Whiting, Indiana

Prepared by:
ENVIRON International Corporation
Nashville, Tennessee

Date:
April 2011

Project Number:
#20-19696D

ENVIRON

ENVIRON

May 6, 2011

Mr. Rick Solan
BP Products North America
2831 Indianapolis Blvd., Stop 10-2
Whiting, IN 46394

Re: Whole Effluent Toxicity Test Results – April 2011
ENVIRON Project No. 20-19696D

Dear Mr. Solan:

Attached are the results of the *Pimephales promelas* (fathead minnow) chronic (7-day) Whole Effluent Toxicity (WET) test performed with composite samples of Outfall 001 effluent. This cover letter contains a test overview and summary of test results. The detailed report formatted to meet guidelines specified in your NPDES discharge permit (i.e., following the outline in Section 10 of EPA 821-R-02-013) is attached.

Three, 24-hour composite samples were evaluated in the WET test. Testing was conducted in accordance with Permit No. IN0000108. Samples were collected on April 12, 14, and 16, 2011 and used at the ENVIRON Toxicology Laboratory within 36 hours of collection at temperatures meeting the USEPA-required receipt temperature range of 0 to 6.0 °C (see chain-of-custody forms). Test organisms were exposed to effluent concentrations of 6.25, 12.5, 25, 50, and 100 percent effluent and a moderately hard water control. Chronic toxicity test methods followed EPA 821-R-02-013, *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition Section 11*. Test results are presented below:

| Chronic Test Results – Outfall 001 Effluent | |
|---|--------|
| 96-hr LC50 | > 100% |
| TUa (100/LC50) | < 1.0 |
| NOEC Survival (7 day) | 100% |
| NOEC Growth (7 day) | 100% |
| IC25 (7 day) | 84% |
| TUc (100/NOEC _{growth}) | 1.0 |

No acute (96 hour) toxicity was observed (LC50 greater than 100 percent effluent). No chronic (seven day) toxicity was observed in the 100 percent effluent exposures as indicated by survival and growth NOEC (No Observed Effects Concentration) values of 100 percent effluent. This corresponds to an NOEC-based TUc value of 1.0. The chronic 25 percent Inhibition Concentration (IC25) value was 84 percent effluent. The higher average weights of the fish in the middle test concentrations may be the reason for the difference of the NOEC and IC25 values.

201 Summit View Drive, Suite 300, Brentwood, TN 37027
Tel: +1 615.377.4775 Fax: +1 615.377.4976

www.environcorp.com

Lab Certifications: AR (#02-008-0), AZ, CA (#2465), FL (#E87896), IA (#386), KS, KY, LA (#02061), MI, NC, OK (#9973), SC (#84015), T104704410-08-TX, VA, WI (#399050850), WV
Test Results Contained in this Report Meet NELAP Requirements
ENVIRON Test Log No. 13585

2 of 28

Test controls met USEPA criteria for test acceptability. The concentration-response relationship for growth is flat and cannot be described in EPA821-B-00-004 *Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing*. A flat dose-response is indicative of a lack of toxicity. Test precision as measured by the Percent Minimum Significant Difference (PMSD) value for this test was 19.8 percent, which is within the USEPA PMSD bounds of 12 to 30 percent for fathead minnow growth. This test is valid for determination of permit compliance. The monthly reference toxicant test for fathead minnow met all test acceptability criteria and was in acceptable range for determining normal test performance.

In accordance with NELAP requirements for listing the number of report pages, this report contains 28 pages, which include the cover letter, detailed report (Attachment 1), associated chemical data (Attachment 2), statistical analyses and raw data (Attachment 3), chain-of-custody forms (Attachment 4), reference toxicant data (Attachment 5), and associated separator pages.

Thank you for the continued opportunity to be of service to BP Products North America. If you have any questions concerning these data, please call Teri Horsley at (615) 377-4775, ext 168.

Sincerely,

ENVIRON International Corporation



Teri L. Horsley
Project Manager, Ecotoxicology

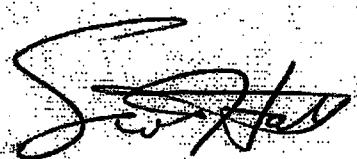


Robin L. Garibay, REM
Principal

cc: Rose Herrera

DATA REVIEW FORM
ACUTE AND CHRONIC WET TESTS
ENVIRON INTERNATIONAL

The raw data (i.e., laboratory bench sheets) and data in the applicable summary sheets have been checked and found to be complete. Additionally, test conditions and control performance meet test acceptability criteria specified by the US Environmental Protection Agency and the certifying state authority for the tests conducted¹.



Scott Hall, Manager
Ecotoxicology Group

¹ Any data limitations regarding their applicability for determining NPDES permit compliance are discussed in the report cover letter.

**Attachment 1:
Detailed Report**

Document ID WBU-DENV-4G05-44084

**BP Whiting Detailed Toxicity Test Report –
April 2011 Fathead Minnow Chronic Test****1 Introduction**

The BP Whiting Refinery is located in Whiting, Indiana at 2815 Indianapolis Boulevard and discharges treated effluent to Lake Michigan under a National Pollutant Discharge Elimination System (NPDES) permit (Permit No. IN0000108) as administered by the Indiana Department of Environmental Management (IDEM). The subject discharge permit requires semi-annual (twice per year) Whole Effluent Toxicity (WET) testing with the fathead minnow. In support of these discharge monitoring requirements, the WET tests described herein were conducted. Testing was performed by:

ENVIRON International Corporation (ENVIRON)
201 Summit View Drive
Lower/Lab Level
Brentwood, TN 37027
(615 377-4775)

The objective of this test was to provide WET test data in support of BP Whiting's NPDES discharge monitoring requirements for Outfall 001/005.

2 Plant Operations

The BP Whiting Refinery produces various grades of gasoline, diesel and heating fuel, asphalt, and coke, among other products from refined crude oil. The facility operates 24 hours a day, seven days per week under normal operations. Some facility processes are occasionally suspended for maintenance or as a result of unplanned events (e.g., equipment failure, etc.). Wastewater treatment consists of bar screening, grit removal, oil/water separator, storm surge tank, equalization tank, flocculation/flotation, activated sludge, settling and multimedia filtration prior to discharge to Lake Michigan. Wastewater retention time is approximately 17 to 18 hours for this approximately average of 20 MGD discharge through Outfall 001. The design flow of the treatment plant at the time of WET test sampling was 35 MGD.

3 Effluent and Dilution Water**3.1 Effluent Samples**

Composite Outfall 001/005 effluent samples were collected from the lake front sample shed at the NPDES permit-specified sample location for WET and chemical sampling of this outfall. Composite samples were obtained from a continuous flow of effluent pulled from the effluent discharge to provide representative effluent samples. The latitude and longitude of this sampling point is 41° 40' 36" N and 87° 28' 16" W. Three effluent samples were collected on the following dates (date indicates the day on which the composite sample was completed): April 12, 14, and 16, 2011. The composite sampler initiated sampling at 0755 for the first sample and 0700 for the second and third samples and sampled hourly for 24 hours on the dates indicated, providing the permit-specified 24 individual sample aliquots (within a 24 hour period) composited for toxicity testing. An Isco automatic sampler was used to collect the hourly samples that were composited into a common sample container (maintained on ice during collection). WET testing was supported by chemical analyses

(Attachment 2). The physical and chemical data associated with each sample used in WET testing are provided on the laboratory bench sheets documenting these and other sample conditions (Attachment 3). The mean daily discharges on sample collection dates were 19.4 mgd, 15.9 mgd, and 18.6 mgd, on April 12, 14, and 16, 2011, respectively. The lapsed time between sample collection and receipt at the ENVIRON WET testing laboratory was 24 hours and 40 minutes, 25 hours and 19 minutes, and 27 hours and 35 minutes, for samples received on April 12, 14, and 16, respectively. The respective sample receipt temperatures were 0.1 °C, 0.4 °C, and 1.0 °C.

3.2 Dilution Water

The dilution and control water for this test was USEPA moderately hard water, prepared in accordance with EPA 821-R-02-013. The water was prepared by ENVIRON using de-ionized water to which the four reagent-grade salts specified by USEPA were added and aerated for a minimum of 24 hours before use. No pre-treatment of the water occurred following this preparation. As detailed in Attachment 3, dilution water hardness and alkalinity ranged from 84 to 88 mg/L CaCO₃ and from 52 to 53 mg/L CaCO₃, respectively. Control water pH ranged from approximately 7.4 to 8.0 s.u., and dissolved oxygen was always greater than 7 mg/L during the test.

4 Test Method

The fathead minnow chronic WET test method detailed in Section 1000.0 of EPA 821-R-02-013 (*Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms – Fourth Edition*) was followed. Per the method, seven-day fathead minnow survival and growth (dry weight) were the test endpoints assessed. There were no deviations from this test method. The test was initiated at 1048 on April 12 and terminated at 1228 on April 19, 2010. Disposable plastic 400 mL test vessels containing 350 mL test solutions were used. Four replicate exposures of 10 organisms were used for each of the five effluent exposures and the control exposures. Test organisms had been acclimated to the control water at 24 °C prior to test initiation. Test temperatures ranged from 24.0 to 25.0 °C. Neither aeration nor pH adjustment were required during the test. Test organisms were fed a minimum of 0.15 g of live *Artemia* (brine shrimp) nauplii twice daily. Test solutions were renewed daily.

5 Test Organisms

Fathead minnows (*Pimephales promelas*) less than 24 hours old at test initiation were used in this testing. Organisms were obtained from a commercial laboratory (Environmental Consulting and Testing) with whom ENVIRON has a long-standing record of successful use in WET tests. Organisms were obtained from laboratory-reared stock traceable to USEPA cultures. Taxonomic verification is provided by the laboratory. No treatments for disease were used on the fish used in these WET tests.

6 Quality Assurance

Reagent grade sodium chloride (NaCl, Reagents, Inc.) is used in monthly reference toxicant tests conducted to document test organism sensitivity and test endpoint precision. Organisms tested are from the same commercial source used in WET tests, and organism handling and testing in reference toxicant tests is identical to that of WET tests. At the time of this test, the most recently completed reference toxicant test was initiated on April 5,

2011. This test was found to be within method-specified control bounds as indicated in Attachment 5 where the control chart is provided. USEPA moderately hard water was the dilution and control water in all reference toxicant tests. The 25 percent inhibition concentration is used to track reference toxicant test performance and as such the percent minimum significant difference statistic is not applicable. As documented in ENVIRON's Standard Operating Procedures (SOP) manual, pH, dissolved oxygen, and conductivity meters calibrated daily according to manufacturer's instructions were used to document these water quality conditions during reference toxicant tests. Standard, titration-based methods were used to document control water hardness and alkalinity as specified in the ENVIRON SOP manual.

7 Results

Raw WET test data are provided in Attachment 3, serving as documentation of the daily effects observed in each test and control replicate. Final test results are also provided in graphical form in Attachment 3 for the specified biomass basis (i.e., integration of survival and growth endpoints). Commercial software (ToxCalc Version 5.0), which is designed specifically to meet USEPA-specified statistical requirements outlined in Section 9.0 of EPA 821-R-02-013 was used for analysis of the fathead minnow survival and growth data. All of the physical and chemical data associated with the toxicity tests are listed in the test bench sheets provided in Attachment 3. In summary, these are:

| Parameter (units) | Range observed in Test (all exposures) |
|------------------------------------|---|
| pH (s.u.) | 7.39 to 7.98 |
| Dissolved Oxygen (mg/L) | 7.5 to 9.0 |
| Conductivity (μ mno/cm) | 307 to 2,090 |
| Temperature ($^{\circ}$ C) | 24.0 to 24.5 |
| Alkalinity (mg/L CaCO_3) | 65 to 90 (100% effluent) |
| Hardness (mg/L CaCO_3) | 224 to 268 (100% effluent) |

The acute (96 hour) median lethal concentration (LC50) value for this test is greater than 100 percent effluent based on the absence of 50 percent or more mortality in all test exposures (five percent mortality was observed in the 100 percent effluent exposure). This corresponds to an acute toxicity unit (TUa) value of less than 1. The biomass method-based chronic tests endpoints of a 25 percent inhibition concentration (IC25) and No Observed Effects Concentration (NOEC) value based on survival and growth were assessed. The respective IC25 and NOEC values for this test were 83.9 percent and 100 percent effluent. The resulting NOEC-based chronic toxic unit value (TUc) is 1.0. The Percent Minimum Significant Difference (PMSD) value (applicable to the NOEC value only) for this test was 19.8 percent.

Attachment 4 contains chain-of-custody documentation.

8 Conclusions and Recommendations

There are no WET permit limits in the current NPDES discharge permit. Only twice per year monitoring is required. Given that no chronic WET in full-strength effluent was indicated and the dilution present in the receiving system, no additional testing is recommended.

**Attachment 2:
Chemical Data**

Document ID WBU-DENV-4G05-44084

Apr-2011

| LIMS ID | | | Sunday 4/10/2011 1754943/1756310 | | | | Tuesday 4/12/2011 1755819/1756297 | | | | Thursday 4/14/2011 1756811/1757246 | | | |
|-------------------|------------------|-----------------------|--|-----------|-------------|----------|---|-----------|-------------|----------|--|-----------|-------------|----------|
| Parameter | Units of Measure | Analysis Method | Result | Comp/Grab | Sample Date | Tech | Result | Comp/Grab | Sample Date | Tech | Result | Comp/Grab | Sample Date | Tech |
| BOD5 | mg/L | SM 5210 B | 4.5 | Comp | 4/10/2011 | JPO | 4.9 | Comp | 4/12/2011 | JPO | 5.6 | Comp | 4/14/2011 | JPO |
| TSS | mg/L | SM 2540 D | 19.0 | Comp | 4/10/2011 | MDF | 19.6 | Comp | 4/12/2011 | MDF | 26.0 | Comp | 4/14/2011 | MDF |
| COD | mg/L | SM 5220 D | 52 | Comp | 4/10/2011 | JPO | 60 | Comp | 4/12/2011 | JPO | 78 | Comp | 4/14/2011 | JPO |
| Oil & Grease | mg/L | EPA 1664A | 0.4 | Grab | 4/11/2011 | MDF | 2.2 | Grab | 4/13/2011 | MDF | 1.8 | Grab | 4/15/2011 | MDF |
| Ammonia | mg/L | SM 4500 NH3 F | <0.10 | Comp | 4/10/2011 | JPO | <0.10 | Comp | 4/12/2011 | JPO | <0.10 | Comp | 4/14/2011 | JPO |
| Total Chromium | mg/L | SM 3111 B | <0.01 | Comp | 4/10/2011 | JPO | <0.01 | Comp | 4/12/2011 | JPO | <0.01 | Comp | 4/14/2011 | JPO |
| Hexavalent Cr | mg/L | SM 3500 Cr D | <0.005 | Grab | 4/11/2011 | JPO | <0.005 | Grab | 4/13/2011 | JPO | <0.005 | Grab | 4/15/2011 | JPO |
| Phenolics | mg/L | SM 5530 D / EPA 420.1 | <0.01 | Comp | 4/10/2011 | JPO | <0.01 | Comp | 4/12/2011 | JPO | <0.01 | Comp | 4/14/2011 | JPO |
| Phosphorous (PO4) | mg/L | SM 4500 P | 0.01 | Comp | 4/10/2011 | MDF | 0.03 | Comp | 4/12/2011 | MDF | 0.01 | Comp | 4/14/2011 | MDF |
| Sulfides | mg S2-/L | SM 4500 S2- D | <0.01 | Comp | 4/10/2011 | JPO | <0.01 | Comp | 4/12/2011 | JPO | <0.01 | Comp | 4/14/2011 | JPO |
| pH | S.U. | SM 4500 H+ B | 7.0 | Grab | 4/11/2011 | JPO/TT | 7.0 | Grab | 4/13/2011 | JPO/BC | 7.1 | Grab | 4/15/2011 | JPO/BC |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Microbac Tests | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Total Mercury | ng/L | 1631 E | 7.20 | Grab | 4/11/2011 | Microbac | 40.4 | Grab | 4/13/2011 | Microbac | 13.3 | Grab | 4/15/2011 | Microbac |
| Total Vanadium | mg/L | 200.8_R5.4 | 0.042 | Comp | 4/10/2011 | Microbac | 0.078 | Comp | 4/12/2011 | Microbac | 0.19 | Comp | 4/14/2011 | Microbac |

**Attachment 3:
Statistical Analyses and Raw Data**

Document ID WBU-DENV-4G05-44084

20-19696D

ENVIRON

ENVIRON Test Log No. 13585

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Larval Fish Growth and Survival Test-7 Day Biomass

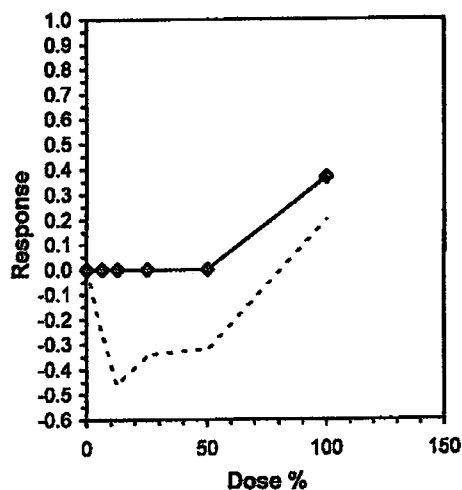
| | | |
|-----------------------|----------------------------------|--------------------------------------|
| Start Date: 4/12/2011 | Test ID: 13585 | Sample ID: BP Whiting |
| End Date: 4/19/2011 | Lab ID: ENVIRON | Sample Type: |
| Sample Date: | Protocol: EPAF 91-EPA Freshwater | Test Species: PP-Pimephales promelas |
| Comments: | | |

| Conc-% | 1 | 2 | 3 | 4 |
|----------|--------|--------|--------|--------|
| Mod Hard | 0.5460 | 0.4630 | 0.4950 | 0.4940 |
| 6.25 | 0.7070 | 0.6730 | 0.6480 | 0.4830 |
| 12.5 | 0.7740 | 0.7000 | 0.7540 | 0.6920 |
| 25 | 0.6870 | 0.7210 | 0.6490 | 0.6450 |
| 50 | 0.5960 | 0.6880 | 0.6140 | 0.7360 |
| 100 | 0.3610 | 0.4660 | 0.3830 | 0.4000 |

| Conc-% | Mean | N-Mean | Transform: Untransformed | | | | | t-Stat | 1-Tailed Critical | MSD | Isotonic | |
|----------|--------|--------|--------------------------|--------|--------|--------|---|--------|-------------------|--------|----------|--------|
| | | | Mean | Min | Max | CV% | N | | | | Mean | N-Mean |
| Mod Hard | 0.4995 | 1.0000 | 0.4995 | 0.4630 | 0.5460 | 6.882 | 4 | | | | 0.6372 | 1.0000 |
| 6.25 | 0.6277 | 1.2568 | 0.6277 | 0.4830 | 0.7070 | 15.848 | 4 | -3.124 | 2.410 | 0.0989 | 0.6372 | 1.0000 |
| 12.5 | 0.7300 | 1.4615 | 0.7300 | 0.6920 | 0.7740 | 5.511 | 4 | -5.615 | 2.410 | 0.0989 | 0.6372 | 1.0000 |
| 25 | 0.6705 | 1.3423 | 0.6705 | 0.6450 | 0.7210 | 5.220 | 4 | -4.165 | 2.410 | 0.0989 | 0.6372 | 1.0000 |
| 50 | 0.6585 | 1.3183 | 0.6585 | 0.5960 | 0.7360 | 9.905 | 4 | -3.873 | 2.410 | 0.0989 | 0.6372 | 1.0000 |
| 100 | 0.4025 | 0.8058 | 0.4025 | 0.3610 | 0.4660 | 11.241 | 4 | 2.363 | 2.410 | 0.0989 | 0.4025 | 0.6316 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test Indicates normal distribution ($p > 0.01$) | 0.94452 | 0.884 | -0.6747 | 1.26151 |
| Bartlett's Test indicates equal variances ($p = 0.38$) | 5.26509 | 15.0863 | | |
| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV | TU |
| Dunnett's Test | 100 | >100 | | 1 |
| | MSDu | MSDp | MSB | MSE |
| | 0.09894 | 0.19807 | 0.06012 | 0.00337 |
| | F-Prob | df | | |
| | 2.1E-06 | 5, 18 | | |

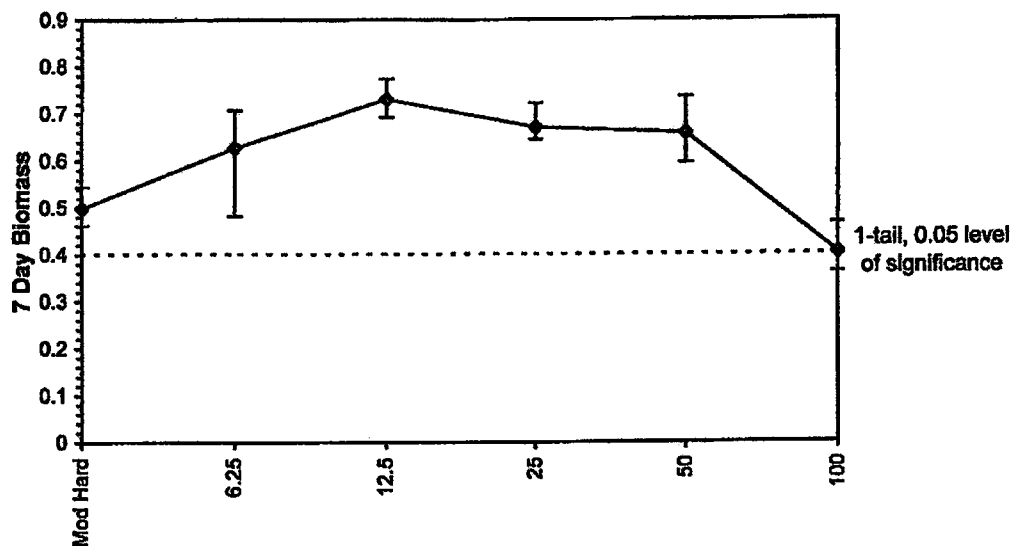
| Linear Interpolation (200 Resamples) | | | | | |
|--------------------------------------|--------|-------|-------------|--------|--------|
| Point | % | SD | 95% CL(Exp) | Skew | |
| IC25 | 83.932 | 3.355 | 76.205 | 96.255 | 0.8732 |



Larval Fish Growth and Survival Test-7 Day Biomass

| | | |
|-----------------------|----------------------------------|--------------------------------------|
| Start Date: 4/12/2011 | Test ID: 13585 | Sample ID: BP Whiting |
| End Date: 4/19/2011 | Lab ID: ENVIRON | Sample Type: |
| Sample Date: | Protocol: EPAF 91-EPA Freshwater | Test Species: PP-Pimephales promelas |
| Comments: | | |

Dose-Response Plot



Larval Fish Growth and Survival Test-7 Day Survival

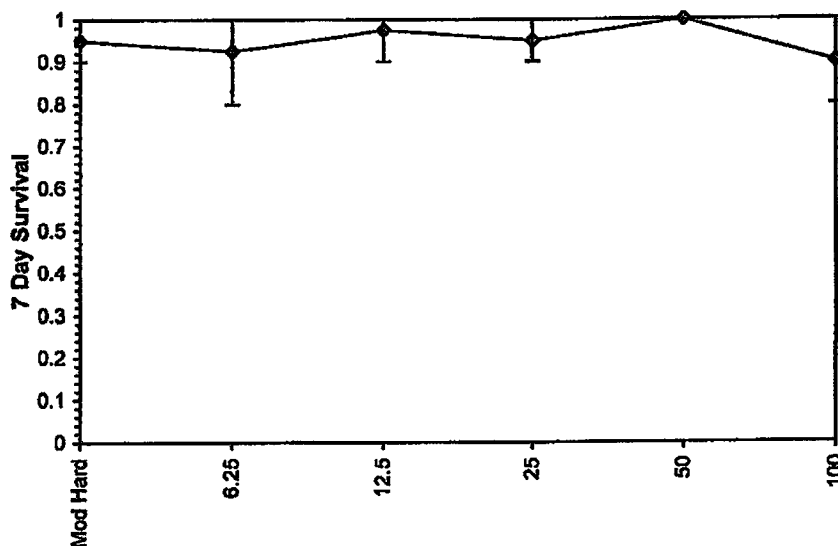
Start Date: 4/12/2011 Test ID: 13585 Sample ID: BP Whiting
 End Date: 4/19/2011 Lab ID: ENVIRON Sample Type:
 Sample Date: Protocol: EPAF 91-EPA Freshwater Test Species: PP-Pimephales promelas
 Comments:

| Conc-% | 1 | 2 | 3 | 4 |
|----------|--------|--------|--------|--------|
| Mod Hard | 0.9000 | 1.0000 | 1.0000 | 0.9000 |
| 6.25 | 1.0000 | 1.0000 | 0.9000 | 0.8000 |
| 12.5 | 0.9000 | 1.0000 | 1.0000 | 1.0000 |
| 25 | 0.9000 | 1.0000 | 1.0000 | 0.9000 |
| 50 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 100 | 0.9000 | 1.0000 | 0.8000 | 0.9000 |

| Conc-% | Mean | N-Mean | Transform: Arcsin Square Root | | | | N | Rank Sum | 1-Tailed Critical |
|----------|--------|--------|-------------------------------|--------|--------|--------|---|----------|-------------------|
| | | | Mean | Min | Max | CV% | | | |
| Mod Hard | 0.9500 | 1.0000 | 1.3305 | 1.2490 | 1.4120 | 7.072 | 4 | | |
| 6.25 | 0.9250 | 0.9737 | 1.2951 | 1.1071 | 1.4120 | 11.347 | 4 | 17.00 | 10.00 |
| 12.5 | 0.9750 | 1.0263 | 1.3713 | 1.2490 | 1.4120 | 5.942 | 4 | 20.00 | 10.00 |
| 25 | 0.9500 | 1.0000 | 1.3305 | 1.2490 | 1.4120 | 7.072 | 4 | 18.00 | 10.00 |
| 50 | 1.0000 | 1.0526 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | 22.00 | 10.00 |
| 100 | 0.9000 | 0.9474 | 1.2543 | 1.1071 | 1.4120 | 9.935 | 4 | 15.00 | 10.00 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$) | 0.96653 | 0.884 | -0.2921 | -0.5388 |
| Equality of variance cannot be confirmed | | | | |
| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV | TU |
| Steel's Many-One Rank Test | 100 | >100 | | 1 |

Dose-Response Plot



ENVIRON FATHEAD MINNOW SURVIVAL AND GROWTH 7-DAY CHRONIC TOXICITY TEST
EPA-821-R-02-013 Method 1000.0

TEST LOG NO.: 13585
JOB NUMBER.: 20-19696D
INDUSTRY: BP Whiting
EFFLUENT: 001
DILUTION WATER: Mod Hard
NPDES: Yes X No
FOOD BATCH: 3292

BEGINNING: HRS: 1048 DATE: 4/12/11
ENDING: HRS: 1228 DATE: 4/19/11
TEST DILUTIONS: 6.25 - 100
ORGANISM AGE (date): 4/11/11
ORGANISM SOURCE: ECT # 3483
SOURCE TEMP @ TEST START: 24.0
RANDOMIZED BY: AW

PHOTOPERIOD: 16 hr light/8 hr dark
FEEDING REGIME:
0.15 mL Artemia @ 2 times/day
TEST VESSEL CAPACITY: 450 mL
TEST SOLUTION VOLUME: 250 - 300 mL
NO. ORGANISMS/TREATMENT: 10
NO. REPLICATES: 4

| CONC (%) | REP ID | SURVIVAL (#) | | | | | | | |
|-------------------|------------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|---------|
| | | START | DAY 1 | DAY 2 | DAY 3 | DAY 4 | DAY 5 | DAY 6 | DAY 7 |
| Mod Hard | A | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 |
| | B | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | C | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | D | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 |
| | E | | | | | | | | |
| | Temp(°C):old/new | 24.0 | 24.1/24.1 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0 |
| 6.25% | A | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | B | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | C | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 |
| | D | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 8 |
| | E | | | | | | | | |
| | Temp(°C):old/new | 24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.1/24.0 | 24.0/24.0 | 24.0/24.0 | 24.3 |
| 12.5% | A | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 |
| | B | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | C | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | D | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | E | | | | | | | | |
| | Temp(°C):old/new | 24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.2 |
| 25% | A | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 |
| | B | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | C | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | D | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 |
| | E | | | | | | | | |
| | Temp(°C):old/new | 24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.3 |
| 50% | A | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | B | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | C | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | D | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | E | | | | | | | | |
| | Temp(°C):old/new | 24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.3 |
| 100% | A | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 |
| | B | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | C | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 8 |
| | D | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 |
| | E | | | | | | | | |
| | Temp(°C):old/new | 24.0 | 24.1/24.1 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.0/24.0 | 24.3 |
| Test Renewal | Time | 1048 | 0927 | 1015 | 0913 | 1155 | 1100 | 0909 | 1228 |
| | Date | 4/12/11 | 4/13/11 | 4/14/11 | 4/15/11 | 4/16/11 | 4/17/11 | 4/18/11 | 4/19/11 |
| | Initials | AW | AW | AW | AW | AW | AW | AW | AW |
| morning feeding | In/Time | | L10655 | L10703 | L10705 | AW0806 | AW0811 | L10646 | |
| afternoon feeding | In/Time | | AW1557 | AW1503 | AW1507 | AW1455 | AW1455 | AW1618 | |

ENVIRON FATHEAD MINNOW SURVIVAL AND GROWTH 7-DAY CHRONIC TOXICITY TEST
EPA-821-R-02-013 Method 1000.0

TEST LOG NO.: 13585 BEGINNING: HRS: 1040 DATE: 4/11/11
JOB NO.: 20-19896D ENDING: HRS: 1230 DATE: 4/11/11
INDUSTRY: BP Whiting
EFFLUENT: 001 NO. ORGANISMS/TREATMENT: 10
NPDES: Yes No NO. REPLICATES: 4

PHOTOPERIOD: 16 hr light
FEEDING REGIME:
0.15 mL Artemia @ 2 times/day
TEST VESSEL CAPACITY: 450 mL
TEST SOLUTION VOLUME: 250 mL

| GROWTH RESULTS | | | | | | | |
|------------------|--------|---------|-----------------------|-----------------|-----------------|-----------|----------------------------------|
| CONC (%) | REP ID | Boat ID | Tare wt (g) | Combined wt (g) | Tot Fish wt (g) | # of Fish | Fish Wt (mg) Per Final # of Fish |
| Mod Hard | A | 1 | 1.12523 | 1.13069 | 0.06546 | 9 | 0.10010 |
| | B | 2 | 1.14444 | 1.14907 | 0.04463 | 10 | 0.4463 |
| | C | 3 | 1.11390 | 1.11831 | 0.04495 | 10 | 0.4495 |
| | D | 4 | 1.14240 | 1.14734 | 0.04494 | 9 | 0.548 |
| | E | | | | | | |
| 6.25% | A | 5 | 1.14217 | 1.14984 | 0.06707 | 10 | |
| | B | 6 | 1.12895 | 1.13508 | 0.06173 | 10 | |
| | C | 7 | 1.11809 | 1.12457 | 0.06148 | 9 | |
| | D | 8 | 1.12041 | 1.12524 | 0.06483 | 8 | |
| | E | | | | | | |
| 12.5% | A | 9 | 1.11906 | 1.12680 | 0.06774 | 9 | |
| | B | 10 | 1.13389 | 1.14089 | 0.06700 | 10 | |
| | C | 11 | 1.14183 | 1.14937 | 0.06754 | 10 | |
| | D | 12 | 1.15445 | 1.16209 | 0.06702 | 10 | |
| | E | | | | | | |
| 25% | A | 13 | 1.12404 | 1.13071 | 0.06067 | 9 | |
| | B | 14 | 1.11970 | 1.12649 | 0.06731 | 10 | |
| | C | 15 | 1.12720 | 1.13369 | 0.06049 | 10 | |
| | D | 16 | 1.06597 | 1.07242 | 0.06045 | 9 | |
| | E | | | | | | |
| 50% | A | 17 | 1.07184 | 1.07780 | 0.06596 | 10 | |
| | B | 18 | 1.09199 | 1.09887 | 0.06688 | 10 | |
| | C | 19 | 1.12378 | 1.12992 | 0.06614 | 10 | |
| | D | 20 | 1.07825 | 1.08561 | 0.06736 | 10 | |
| | E | | | | | | |
| 100% | A | 21 | 1.12977 | 1.13338 | 0.06361 | 9 | |
| | B | 22 | 1.13723 | 1.14189 | 0.06466 | 10 | |
| | C | 23 | 1.11807 | 1.12190 | 0.06383 | 8 | |
| | D | 24 | 1.13542 | 1.13942 | 0.06400 | 9 | |
| | E | | | | | | |
| | A | | | | | | |
| | B | | | | | | |
| | C | | | | | | |
| | D | | | | | | |
| | E | | | | | | |
| Initials / Date: | | | AM 4/11/11 AM 4/11/11 | | | | |

AVG Control Fish wt. 0.528mg
(using final #)

Oven ID: 2

Temp 101 Tins In: 4/11/11 1315
 Date/Time
 Temp 103 Tins Out: 4/11/11 1800
 Date/Time

FINAL WEIGHTS

 DATE: 4/11/11
 INITIALS: HP

JOB NO.

CLIENT/SAMPLE ID: BP Whiting

TEST ORGANISM: FM

DATE:

11/21/16

ENVIRON Test Log No. 13585

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[illegible]

TEST LOG NO. 13585
 JOB NO. 20-19696D

CLIENT: BP Whiting
 TEST TYPE(S) PERFORMED: Fm Chronic

DATE OF TEST: 4/12/11

100% EFFLUENT

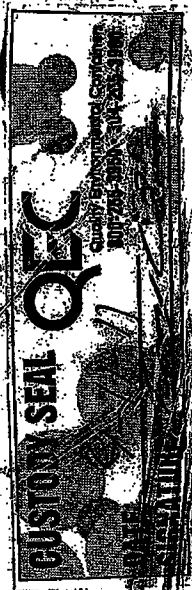
| Batch # | Sample ID | Sample Date | 1st Use Date | Hardness mg/L CaCO ₃ | Alkalinity mg/L | TRC mg/L | NH ₃ N mg/L |
|---------|-------------|--------------|--------------|------------------------------------|--------------------|-------------|---------------------------|
| 13658 | Outfall 001 | 4/10-11/11 | 4/12/11 | 268 | 90 | 20.02 | <0.1 |
| 13664 | Outfall 001 | 4/12/11 | 4/14/11 | 832 | 125 | 0.03 | <0.1 |
| 13667 | Outfall 001 | 4/14-4/15/11 | 4/16/11 | 224 | 86 | 0.04 | <0.1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

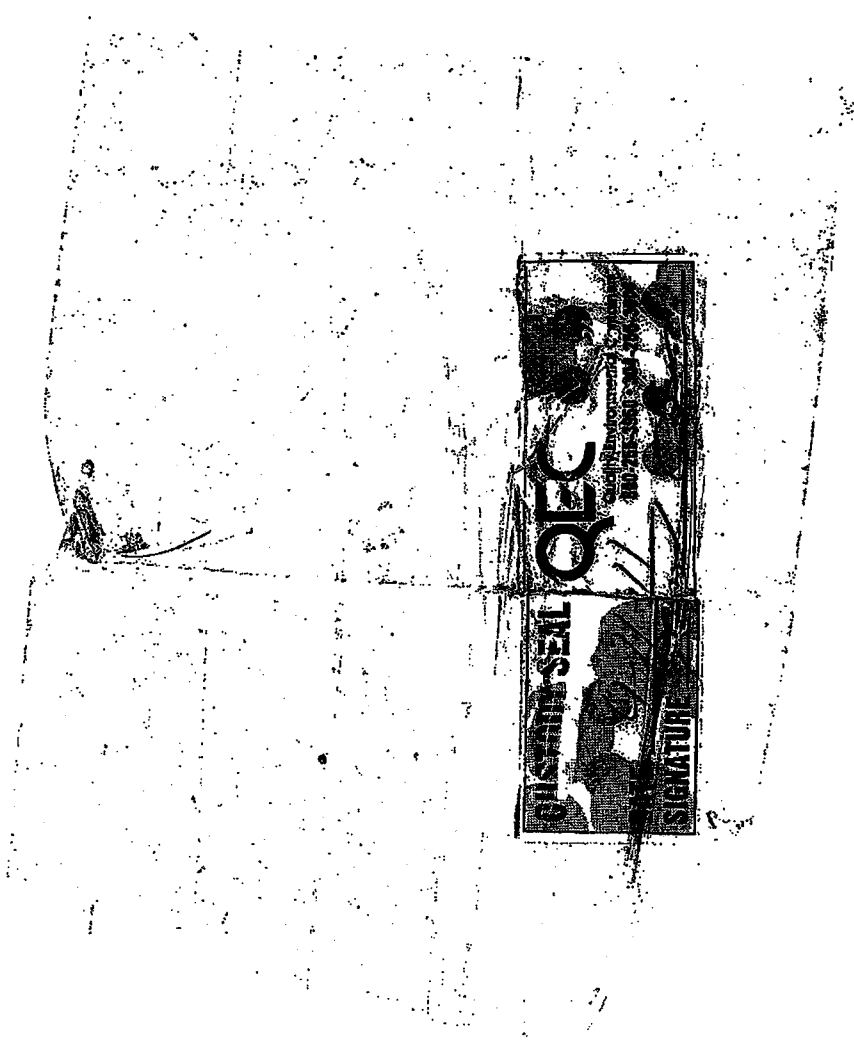
CONTROL / DILUTION WATER

| Batch # | Sample ID | Sample Date (made) | 1st Use Date | Hardness mg/L CaCO ₃ | Alkalinity mg/L | TRC mg/L |
|---------|-----------|--------------------|--------------|------------------------------------|--------------------|-------------|
| 4485 | MH | 4/8/11 | 4/12/11 | 89 | 52 | 20.02 |
| 4485 | MH | 4/10/11 | 4/15/11 | 88 | 53 | 20.02 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Attachment 4:
Chain-of-Custody Documentation**

Document ID WBU-DENV-4G05-44084





Document ID WBU-DENV-4G05-44084



Document ID WBU-DENV-4G05-44084

**Attachment 5:
Reference Toxicant Data**

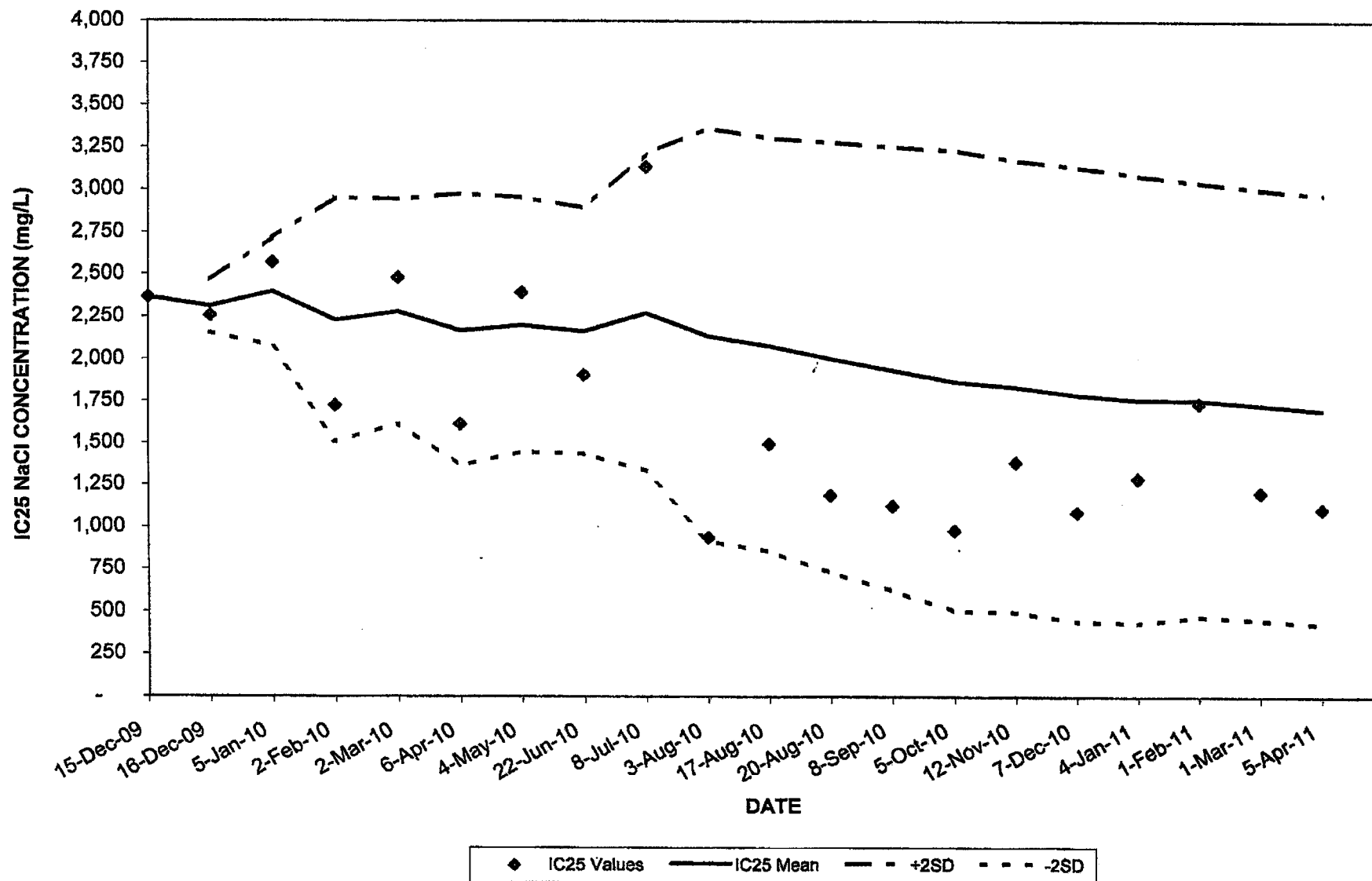
20-19696D

ENVIRON

ENVIRON Test Log No. 13585

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CHRONIC REFERENCE TOXICANT TEST (NaCl) 2009 - 2011 FATHEAD MINNOWS



Fathead Minnow CHRONIC REFERENCE TOXICANT TESTING-SODIUM CHLORIDE (NaCl) 2009 - 2011

ENVIRON Test Log No. 13685

28 of 28

| Test Number | Log Number | Test Initiation Date | Control Survival (%) (*) | Control Mean Dry Weight (mg/fish) (*) | SURVIVAL | | GROWTH | | PMSD (%) | IC25 VALUE (mg/L) | IC25 CUMULATIVE MEAN (mg/L) | IC25 ST. DEV. (mg/L) | IC25 2+ STD. DEV. | IC25 2- STD. DEV. | Coefficient of Variation (%) |
|-------------|------------|----------------------|--------------------------|---------------------------------------|-------------|-------------|-------------|-------------|----------|-------------------|-----------------------------|----------------------|-------------------|-------------------|------------------------------|
| | | | | | NOEC (mg/L) | LOEC (mg/L) | NOEC (mg/L) | LOEC (mg/L) | | | | | | | |
| 1 | 11388 | 15-Dec-09 | 95 | 0.545 | 1,500 | 3,000 | 1,500 | 3,000 | 30.7 | 2,364 | 2,364 | | | | |
| 2 | 11395 | 16-Dec-09 | 100 | 0.494 | 1,500 | 3,000 | 1,500 | 3,000 | 19.6 | 2,265 | 2,310 | 77 | 2,464 | 2,155 | 2 |
| 3 | 11415 | 05-Jan-10 | 100 | 0.617 | 1,500 | 3,000 | 1,500 | 3,000 | 23.8 | 2,569 | 2,396 | 159 | 2,715 | 2,077 | 5 |
| 4 | 11478 | 02-Feb-10 | 87.5 | 0.431 | 1,500 | 3,000 | 1,500 | 3,000 | 46.5 | 1,723 | 2,228 | 361 | 2,949 | 1,506 | 14 |
| 5 | 11528 | 02-Mar-10 | 92.5 | 0.420 | 1,500 | 3,000 | 1,500 | 3,000 | 22.1 | 2,478 | 2,278 | 332 | 2,942 | 1,614 | 13 |
| 6 | 11605 | 06-Apr-10 | 100 | 0.557 | 1,500 | 3,000 | 1,500 | 3,000 | 35.7 | 1,612 | 2,167 | 403 | 2,972 | 1,362 | 17 |
| 7 | 11662 | 04-May-10 | 97.5 | 0.246 | 6,000 | >6,000 | 1,500 | 3,000 | 28.9 | 2,392 | 2,199 | 377 | 2,953 | 1,445 | 16 |
| 8 | 12765 | 22-Jun-10 | 100 | 0.452 | 1,500 | 3,000 | 750 | 1,500 | 12.1 | 1,904 | 2,162 | 364 | 2,891 | 1,433 | 16 |
| 9 | 12787 | 08-Jul-10 | 100 | 0.523 | 1,500 | 3,000 | 1,500 | 3,000 | 16.4 | 3,132 | 2,270 | 470 | 3,210 | 1,330 | 20 |
| 10 | 12824 | 03-Aug-10 | 95 | 0.509 | 6,000 | >6,000 | 375 | 750 | 16.7 | 934 | 2,136 | 612 | 3,360 | 912 | 27 |
| 11 | 12870 | 17-Aug-10 | 100 | 0.438 | 750 | 1,500 | 750 | 1,500 | 20.8 | 1,492 | 2,078 | 612 | 3,302 | 853 | 28 |
| 12 | 12878 | 20-Aug-10 | 100 | 0.433 | 750 | 1,500 | 750 | 1,500 | 25.2 | 1,187 | 2,004 | 638 | 3,279 | 728 | 30 |
| 13 | 12904 | 08-Sep-10 | 95 | 0.492 | 750 | 1,500 | 750 | 1,500 | 14.6 | 1,124 | 1,936 | 658 | 3,251 | 620 | 33 |
| 14 | 12963 | 05-Oct-10 | 100 | 0.663 | 750 | 1,500 | 750 | 1,500 | 28.7 | 977 | 1,867 | 682 | 3,231 | 504 | 35 |
| 15 | 13035 | 12-Nov-10 | 97.5 | 0.364 | 750 | 1,500 | 750 | 1,500 | 22.3 | 1,382 | 1,835 | 669 | 3,173 | 497 | 35 |
| 16 | 13067 | 07-Dec-10 | 95 | 0.445 | 750 | 1,500 | 750 | 1,500 | 38.7 | 1,086 | 1,788 | 673 | 3,134 | 443 | 36 |
| 17 | 13089 | 04-Jan-11 | 100 | 0.511 | 750 | 1,500 | 750 | 1,500 | 19.7 | 1,286 | 1,759 | 663 | 3,084 | 433 | 37 |
| 18 | 13147 | 01-Feb-11 | 100 | 0.547 | 1,500 | 3,000 | 1,500 | 3,000 | 31.2 | 1,737 | 1,757 | 643 | 3,043 | 472 | 36 |
| 19 | 13214 | 01-Mar-11 | 95 | 0.583 | 6,000 | >6,000 | 750 | 1,500 | 25.7 | 1,203 | 1,728 | 638 | 3,004 | 453 | 36 |
| 20 | 13572 | 05-Apr-11 | 100 | 0.530 | 750 | 1,500 | 750 | 1,500 | 24.2 | 1,106 | 1,697 | 636 | 2,969 | 425 | 37 |
| Avg | | | 98 | 0.490 | 1875 | 1960 | 1069 | 2138 | | 1697 | 2048 | 509 | 3049 | 1014 | |

Notes:

Dilution series - 0.375 g/L - 6.0 g/L

NOEC - No Observable Effect Concentration (survival or growth)

LOEC - Lowest Observable Effect Concentration (survival or growth)

ACCEPTABLE TEST RESULTS - A growth NOEC ranging from 750 mg/L to 3,000 mg/L

(*) Minimum USEPA CONTROL CRITERIA - 80 percent survival and average dry weight of 0.25 mg (weight based on surviving number of fish).

^ Test run with ARO fish